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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. PAT 324-2
First Inventor ZHANG, Hang
Title Method for Reducing ...
Express Mail Label No.

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☒ Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☐ Applicant claims small entity status.
See 37 CFR 1.27.
3. ☒ Specification [Total Pages 13]
(preferred arrangement set forth below)
 - Descriptive title of the invention
 - Cross Reference to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to sequence listing, a table, or a computer program listing appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 5]
5. Oath or Declaration [Total Pages 2]
 - a. ☒ Newly executed (original or copy)
Copy from a prior application (37 CFR 1.63 (d))
 - b. ☐ (for continuation/divisional with Box 18 completed)
 - i. ☐ **DELETION OF INVENTOR(S)**
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☐ Application Data Sheet. See 37 CFR 1.76

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)
8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
 - a. ☐ Computer Readable Form (CRF)
 - b. Specification Sequence Listing on:
 - i. ☐ CD-ROM or CD-R (2 copies); or
 - ii. ☐ paper
 - c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☒ Assignment Papers (cover sheet & document(s))
10. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☒ Power of Attorney
11. ☐ English Translation Document (if applicable)
12. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
13. ☐ Preliminary Amendment
14. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☐ Request and Certification under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.
17. ☐ Other:

18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment, or in an Application Data Sheet under 37 CFR 1.76:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____
Prior application information Examiner _____ Group Art Unit, _____

For CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

19. CORRESPONDENCE ADDRESS

☒ Customer Number or Bar Code Label (Insert Customer Number or Bar Code Label here) or ☐ Correspondence address below

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PATENT TRADEMARK OFFICE
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City State Zip Code
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Name (Print/Type) Leslie Anne Kinsman Registration No. (Attorney/Agent) 45,291
Signature [Signature] Date Nov. 24, 2000

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**FEE TRANSMITTAL
for FY 2001**

Patent fees are subject to annual revision.

Complete if Known

Application Number	
Filing Date	
First Named Inventor	ZHANG, Hang
Examiner Name	
Group Art Unit	
Attorney Docket No.	PAT 324-2

TOTAL AMOUNT OF PAYMENT (\$)**902.00****METHOD OF PAYMENT**

- 1.
- ☐
- The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to

Deposit Account Number	501593
Deposit Account Name	Borden Ladner Gervais LLP

- ☒
- Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

☐ Applicant claims small entity status See 37 CFR 1.27

- 2.
- ☒
- Payment Enclosed:

☒ Check ☐ Credit card ☐ Money Order ☐ Other**FEE CALCULATION****1. BASIC FILING FEE**

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
101 710	201 355	Utility filing fee	710.
106 320	206 160	Design filing fee	
107 490	207 245	Plant filing fee	
108 710	208 355	Reissue filing fee	
114 150	214 75	Provisional filing fee	

SUBTOTAL (1) (\$)**710.****2. EXTRA CLAIM FEES**

Total Claims	Extra Claims	Fee from below	Fee Paid
24	-20** = 4	18	72
4	-3** = 1	80	80
Multiple Dependent			--

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description
103 18	203 9	Claims in excess of 20
102 80	202 40	Independent claims in excess of 3
104 270	204 135	Multiple dependent claim, if not paid
109 80	209 40	** Reissue independent claims over original patent
110 18	210 9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) (\$)**152.**

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)**3. ADDITIONAL FEES**

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
105 130	205 65	Surcharge - late filing fee or oath	
127 50	227 25	Surcharge - late provisional filing fee or cover sheet	
139 130	139 130	Non-English specification	
147 2,520	147 2,520	For filing a request for ex parte reexamination	
112 920*	112 920*	Requesting publication of SIR prior to Examiner action	
113 1,840*	113 1,840*	Requesting publication of SIR after Examiner action	
115 110	215 55	Extension for reply within first month	
116 390	216 195	Extension for reply within second month	
117 890	217 445	Extension for reply within third month	
118 1,390	218 695	Extension for reply within fourth month	
128 1,890	228 945	Extension for reply within fifth month	
119 310	219 155	Notice of Appeal	
120 310	220 155	Filing a brief in support of an appeal	
121 270	221 135	Request for oral hearing	
138 1,510	138 1,510	Petition to institute a public use proceeding	
140 110	240 55	Petition to revive - unavoidable	
141 1,240	241 620	Petition to revive - unintentional	
142 1,240	242 620	Utility issue fee (or reissue)	
143 440	243 220	Design issue fee	
144 600	244 300	Plant issue fee	
122 130	122 130	Petitions to the Commissioner	
123 50	123 50	Processing fee under 37 CFR 1.17(q)	
126 180	126 180	Submission of Information Disclosure Stmt	
581 40	581 40	Recording each patent assignment per property (times number of properties)	40.
146 710	246 355	Filing a submission after final rejection (37 CFR § 1.129(a))	
149 710	249 355	For each additional invention to be examined (37 CFR § 1.129(b))	
179 710	279 355	Request for Continued Examination (RCE)	
169 900	169 900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$)**40.****SUBMITTED BY**

Name (Print/Type)	Leslie Anne Kinsman	Registration No. (Attorney/Agent)	45,291	Complete (if applicable)	Telephone	613-237-5160
Signature	<i>Leslie Anne Kinsman</i>	Date	Nov. 24, 2000			

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METHOD FOR REDUCING OVERHEAD IN FORWARD LINK TRAFFIC
MULTIPLEXING

FIELD OF THE INVENTION

5 The present invention relates generally to wireless communications. More particularly, the present invention relates to a method for reducing overhead in forward link traffic multiplexing, and frame structure for achieving such reduction.

BACKGROUND OF THE INVENTION

10 The design of current third generation (3G), and enhanced 3G, wireless access networks is driven by the need for high speed internet access. Increasingly, consumers are moving to wireless communications for the delivery of services and applications using conventional TCP/IP (Transmission Control Protocol/Internet Protocol), or other packet-based protocols. This trend is growing with the increase in internet-enabled wireless devices
15 available to users, including cellular telephones, Personal Digital Assistants (PDAs), and other devices. The applications that are now available, or contemplated, for wireless devices include access to services such as the World Wide Web, video telephony, voice over IP and e-mail, etc.

20 Current wireless access networks, both second generation (2G) and 3G systems, are connection-oriented designs. In 2G systems, a physical connection, or radio link, is set up between a wireless terminal, mobile or fixed, and the network by a simple call setup procedure. Such a call setup procedure includes information exchange, or authentication, and resource allocation, or channel assignment, for both the forward link and the reverse link. After this call setup procedure, the resources allocated are dedicated to the user until the call
25 is released. Any traffic received by the terminal on the dedicated forward link channel belongs to this terminal. Any traffic received by the network on the dedicated reverse link is from the terminal. Such connection-oriented design is suitable to stream type of applications, such as voice, video and audio. However, for internet packet applications, significant resources are wasted due to the characteristically high burstyness of packet applications.

30 In order to increase the efficiency of resource utilization, current 3G systems, such as those developed under the cdma2000 1xRTT standard and the Universal Mobile

Telecommunications System (UMTS), can provide resource sharing on forward link supplemental channels. A single supplemental channel can be shared among multiple terminals on a Time Division Multiple Access (TDMA) basis. The supplemental channel is allocated to a terminal for a certain period of time, generally in the range of a few tens of milliseconds, by a procedure called burst transmission.

The above-described resource allocation mechanisms, whether dedicated channels or dedicated time slices, are both essentially connection-oriented. Once a resource is allocated to a terminal, whether there is traffic to the terminal or not, the resource is always occupied by this terminal. While this makes user traffic identification simple, these designs are not optimal for internet packet applications.

High speed wireless internet access, through packet-based wireless access networks, is currently being developed. In a packet-based wireless access network, radio resources are dynamically allocated to users on packet-by-packet basis for increased system capacity. Such dynamic resource sharing on the forward link requires users to efficiently identify traffic directed to them. Typically, a user ID is used for this purpose. Each user packet is encapsulated in a radio link protocol (RLP) frame for the purpose of retransmission over a radio link. An appropriate user ID precedes each packet in the RLP frame, and is used by the terminals to identify their traffic.

One example of such a forward link traffic multiplexing format is shown in **Fig. 1**. User packets are encapsulated in RLP frames **50**. The RLP frames **50** are then assembled into a forward link traffic multiplexing frame **52** with an appropriate user identification (ID) **54** preceding each RLP frame **50**. The user IDs **54** are generally N-bit binary strings.

The forward link traffic multiplexing frame **52** is a layer 2 (L2) frame. The functions of L2 in a wireless access network are mainly resource management, traffic multiplexing and radio link quality improvement. As will be understood by those of skill in the art, some overhead including the user IDs **54** is introduced by L2, and this overhead occupies certain system resources. Clearly, more user traffic, as opposed to overhead, can be transmitted in each forward link traffic multiplexing frame if this overhead can be reduced.

This problem becomes especially acute as wireless internet access increases, and more services are provided by internet, such as stock information, weather forecasts, mobile location notices, etc. Such applications share common characteristics, such as very short

packet sizes in the range of a few bytes, very bursty transmission, and delay insensitivity as compared to stream type applications. L2 control packets are also typically very short and quite bursty. For both these types of packets sent on a forward multiplexing channel, the user ID can account for significant percentage of the L2 frame.

5 It is, therefore, desirable to provide a method and frame structure that minimizes L2 overhead, such that more user traffic can be supported, thereby increasing system capacity and throughput.

SUMMARY OF THE INVENTION

10 It is an object of the present invention to obviate or mitigate at least one disadvantage of previous methods for reducing overhead in wireless communications. In particular, it is an object of the present invention to present an improved method and frame structure for forward link traffic multiplexing.

15 In a first aspect, the present invention provides a method for assembling a forward link traffic multiplexing frame for transmission of a plurality of packets over a radio link. The method consist of determining which of a plurality of packets is associated to a group. The packets belonging to the group are then assembled in a forward link traffic multiplexing frame in which the group is identified, by a group identifier or a group identification field, and the packets in the group are identified according to the terminal or user to which they are
20 destined. Such packet identification is typically achieved by providing a sub-user identifier for each packet. In a presently preferred embodiment of this method of the present invention, the number or length of the packets in the group is provided, as is the number or length of groups within the multiplexing frame.

25 According to a second aspect of the present invention, there is provided a forward link traffic multiplexing frame structure for transmission of a plurality of packets over a radio link. The frame structure includes a plurality of packets that are associated to a group, a group identification, such as a group identifier or a group identification field, and a sub-user identification for each packet, such as a sub-user identifier. The group identification can also include the length or number of packets in the group. Typically, a plurality of groups are
30 included in the frame, and a multiplex header is provided that includes the number of groups in the frame.

In a further aspect, the present invention provides a method for detecting a packet, in a forward link traffic multiplexing frame, that is destined to a terminal. The method begins with receiving the forward link traffic multiplexing frame at the terminal. The frame is then examined to determine if a group associated to the terminal is included in the frame. A group identifier or group identification field can be used to make this determination. The group is then examined, such as by examining sub-user identifiers associated with each packet in the group, to determine if packet(s) destined to the terminal is contained within the group. Such packet(s) are then retrieved.

A further aspect of the present invention provides a wireless access network for transmitting a plurality of packets over a radio link. The wireless access network includes a scheduler for scheduling a plurality of packets for transmission over a radio link. The scheduler passes the scheduled packets to a multiplexer that assembles them into a forward link traffic multiplexing frame. The multiplexer determines which packets are associated to a group, and assembles the group of packets into the forward link traffic multiplexing frame while providing an identification of the group an identification of a destined terminal for each of the packets in the group.

Other aspects and features of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described, by way of example only, with reference to the attached Figures, wherein:

Fig. 1 is a diagram showing the assembly of a forward link multiplexing frame according to the prior art;

Fig. 2 is a block diagram of a wireless communication system according to the present invention;

Fig. 3 is a diagram showing the assembly of a forward link multiplexing frame according to a first embodiment of the present invention;

Fig. 4 is a diagram showing the assembly of a forward link multiplexing frame according to a second embodiment of the present invention; and

Fig. 5 is a diagram showing an example of the second embodiment of Fig. 3.

DETAILED DESCRIPTION

In current dynamic forward link multiplexing systems, a user accesses a wireless network **100** and is assigned a user identifier (ID) for the purposes of traffic identification. The user ID consists of N bits of information that uniquely identifies the user. As used herein, a user is a wireless terminal **102**, whether mobile or fixed. Generally, the present invention provides a method and L2 frame structure for reducing overhead in forward link traffic multiplexing by determining a group identification and a user identification for each packet by splitting the N-bit user ID into a group ID N_1 and a sub-user ID N_2 , where $N = N_1 + N_2$. Packets are then associated to their respective group, based on their group ID. The group is then assembled in a forward link traffic multiplexing frame, and the packets in the group are identified according to the terminal, or user, to which they are destined, as determined by their sub-user ID.

In forward link multiplexing, a scheduler **104** schedules packets, received from servers **108** or from other terminals **102**, to multiple users based on certain criteria, such as the packets' quality of service (QoS) criteria. Once the scheduler **104** makes its decision concerning which packets are to be sent in a current frame, a multiplexer **106** assembles the packets into the current frame and appends appropriate header and packet identification information, such that the receiving terminals **102** can identify their respective packets. Typically, prior to assembly by the multiplexer **106**, the packets are encapsulated as RLP frames that include information relative to such functions as retransmission. In order to simplify the description of the present invention, it is assumed that each RLP frame includes one packet, and the terms "packet" and "RLP frame" are used interchangeably. However, as will be apparent to those of skill in the art, an RLP frame can encapsulate multiple packets destined to a single user, or can encapsulate a fragment of an RLP frame, and the present invention is intended to encompass both single packet RLP frames, RLP frame fragments, and multiple packet RLP frames. Once encapsulated, the RLP frames are transmitted, according to appropriate layer 1 protocols, over a radio link **110**.

Referring to **Fig. 2** and **Fig. 3**, a first embodiment of the present invention is presented. The N-bit user ID, referred to above, is split into two parts, N_1 and N_2 , where N_1 is

a group ID **200**, N_2 is a sub-user ID **202**, and $N = N_1 + N_2$. All the users with the same group ID **200** are associated to the same group, while each user in a particular group is identified by its sub-user ID **202**. As illustrated in **Fig. 2**, a number of RLP frames **204 - 216** are scheduled for transmission in a current frame. The user IDs of RLP frames **204 - 216** have been split, and grouped according to their respective group IDs **200i**, **200j**, and **200n**. RLP frames **204**, **206**, and **208** are destined to users of a **Group i**, RLP frames **210** and **212** are destined to users of a **Group j**, and RLP frames **214** and **216** are destined to users of a **Group n**.

At the network side, the multiplexer **106** assembles a forward link multiplexing (MUX) frame **220**. The multiplexer **106** groups together RLP frames from the same group. For example, as shown, the RLP frames **204 - 208**, destined to users of **Group i**, are first assembled into the MUX frame **220**. Preceding **Group i**, the group ID **200i** is added to identify **Group i**. A group length field **224** follows the group ID **200i**. The group length field **224** indicates the octet length of the group. Alternatively, particularly for fixed length RLP frames, a group number field can be used to indicate the number of RLP frames in the group (i.e. for **Group i**, the number field would indicate that three RLP frames are included in the group). Together, the group ID **200** and group length field **224** provide the group identification. Within **Group i**, the RLP frames **204 - 208** are each preceded by their respective sub-user IDs **202** to provide appropriate user identification. The user traffic for the remaining groups **Group j** to **Group n** is encapsulated in the MUX frame **220** in a similar fashion. Each group is preceded by its respective group ID **200j - 200n**, and group length field **224**, and each RLP frame is preceded by its respective sub-user ID **202**. A MUX frame header **230** is appended to the beginning of MUX frame **220**. The MUX frame header **230** can include, for example, a frame-type field to indicate that the frame includes traffic from multiple users, and a number field to indicate the number of groups in MUX frame **220**.

As will be understood by those of skill in the art, while the illustrated embodiment shows a group length, or number, field **224**, length or number fields can also be provided to identify the length or size of the MUX frame **220**, and the length of the RLP frames. Fields identifying the length of RLP frames can follow the group ID, or can follow the sub-user ID, as appropriate. Generally, number fields are more appropriate for systems transmitting fixed length RLP frames, whereas length fields are more appropriate for systems relaying variable length RLP frames. Ultimately, the choice of which of the MUX, group and/or RLP frames

are provided with length and/or number fields is dependent on system design and optimization criteria.

At the receiving end, once the MUX frame **220** is transmitted over the forward link multiplexing channel **110**, terminals **102** having access to the channel receive the MUX frame **220** and must determine whether the frame includes user traffic that is destined to them. Each terminal first examines the group IDs **200** to determine if the MUX frame **220** includes a group associated with the terminal. If a group associated with the terminal is contained within MUX frame **220**, the terminal examines the sub-user IDs **202** within the group to determine if the group contains a packet destined to the terminal. If such packet(s) exist, they are retrieved by the terminal and appropriate acknowledgments are sent, as determined by the particular protocols implemented by the wireless access network.

A second embodiment of the present invention is shown in **Fig. 4**. User traffic, consisting of RLP frames **204 - 216**, grouped in **Groups $i - n$** as in the previous example, are scheduled to be assembled into a MUX frame **320**. As opposed to providing a group ID at the beginning of each group, a group ID identification field **322** is inserted after a MUX header **330**, that includes a frame type identification (i.e. multiple user frame). The group identification field **322** which includes 2^{N1} bits, where each bit corresponds to one group. For example, the first bit is for **Group 1**, the M^{th} bit is for **Group M**. If a group's bit is set to "1", it means that there is traffic directed to the corresponding group. Conversely, if a group's bit is set to "0", there is no traffic to the corresponding group. An RLP frame's group ID is used to determine to which group the frame belongs, as in the first embodiment. For each group, there can again be a group length or number field **224** indicating the number of users who's traffic is included in the group in this frame. Within each group, user identification is still provided by sub-user IDs **202** preceding each user's RLP frames. A similar sub-user identification field can be implemented in lieu of the sub-user identifiers.

Once transmitted over a forward link multiplexing channel, MUX frame **320** is received by users having access to the channel. The user examines the group identification field **322** to determine if the MUX frame **220** includes a group associated with the user. If a group associated with the user is contained within MUX frame **220**, the user examines the sub-user IDs **202** within the group, and continues as described above.

Fig. 5 provides an example of the second embodiment of the present invention. The forward link multiplexing channel includes sixteen groups, having four bit binary group IDs from "0000" to "1111", respectively. Packets, encapsulated as RLP frames **404 - 416**, from **Group 2, Group 7** and **Group 14** are scheduled for transmission in the current MUX frame **420**. Packets from Group 2 are identified by a binary group ID of "0001", packets from Group 7 are identified by a binary group ID "1000", and packets from Group 14 are identified by a binary group ID "1101". To indicated that packets from each of these groups are included in the MUX frame **420**, the 2nd, 7th and 14th bits of the group identification field **422** are set to "1", as shown. The groups are assembled in MUX frame **420** in ascending order: i.e. Group 2, followed by Group 7, and then Group 14. A group length field **224** precedes each group to indicate the number of packets from that group are being transmitted in the MUX frame **420**. Within each group, the user's traffic is identified by its respective sub-user ID **202**.

As will be understood by those of skill in the art, the present invention can provide significant reductions in overhead, especially when a large number of short packets are being sent to multiple users. Many short packets from multiple users can be collected and grouped, and all packets from a single group can share a single group ID, with short sub-user IDs providing packet identification within each group. Thus, instead of providing, for example, an 8-bit user ID for each of ten packets, thereby requiring eighty bits of overhead, the user IDs are split to provide a 4-bit group ID and a 4-bit sub-user ID for each packet. All packets having the same group ID are grouped together and the group is identified by one 4-bit group ID, with respective sub-user IDs preceding each packet to identify its user within its group. Assuming that two groups are represented, the overhead is thus reduced by 40% to forty-eight bits. By reducing the L2 overhead in this way, a larger amount of user traffic can be encapsulated in each frame, thereby increasing overall system capacity.

The above-described embodiments of the present invention are intended to be examples only. Alterations, modifications and variations may be effected to the particular embodiments by those of skill in the art without departing from the scope of the invention, which is defined solely by the claims appended hereto.

What is claimed is:

1. A method for assembling a forward link traffic multiplexing frame for transmission of a plurality of packets over a radio link, comprising:

(i) determining a plurality of packets associated to a group; and

5 (ii) assembling the group of determined packets in a forward link traffic multiplexing frame;

(iii) providing an identification of the group in the forward link traffic multiplexing frame; and

10 (iv) providing an identification of a destined terminal for each of the determined packets in the group.

2. The method according to claim 1, wherein providing the identification of the group includes providing a group identifier.

15 3. The method according to claim 1, wherein providing the identification of the group includes providing a group identification field.

20 4. The method according to claim 1, wherein providing the identification of the group includes providing a group length field.

5. The method according to claim 1, wherein providing the identification of the group includes providing a group number field.

25 6. The method according to claim 1, wherein providing the identification of the destined terminal for each of the determined packets includes providing a sub-user identifier.

7. The method according to claim 1, further including assembling a plurality of groups in the forward link multiplexing frame.

30 8. The method according to claim 1, further including providing a multiplex header for the forward link traffic multiplexing frame.

9. The method according to claim 8, wherein providing the multiplex header includes a number field indicating a number of groups in the forward link traffic multiplexing frame.

5 10. A forward link traffic multiplexing frame structure for transmission of a plurality of packets over a radio link, comprising:

a plurality of packets associated to a group

a group identification; and

a sub-user identification for each of the plurality of packets in the group.

10 11. The forward link traffic multiplexing frame structure of claim 10, wherein the group identification includes a group identifier.

15 12. The forward link traffic multiplexing frame structure of claim 10, wherein the group identification includes a group identification field.

13. The forward link traffic multiplexing frame structure of claim 10, wherein the group identification includes a group length field.

20 14. The forward link traffic multiplexing frame structure of claim 10, wherein the group identification includes a group length field.

15. The forward link traffic multiplexing frame structure of claim 10, wherein the sub-user identification includes a sub-user identifier.

25 16. The forward link traffic multiplexing frame structure of claim 10, further including a plurality of groups.

30 17. The forward link traffic multiplexing frame structure of claim 16, further including a number field for indicating the number of groups.

18. The forward link traffic multiplexing frame structure of claim 17, wherein the number field is included in a multiplex frame header.

19. A method for detecting a packet in a forward link traffic multiplexing frame that is destined to a terminal, comprising:

- (i) receiving a forward link traffic multiplexing frame at a terminal;
- (ii) determining that the forward link traffic multiplexing frame includes a group associated to the terminal;
- (iii) determining that the group includes a packet destined to the terminal; and
- (iv) retrieving the packet.

20. The method according to claim 19, wherein determining that the forward link traffic multiplexing frame includes a group associated to the terminal includes examining a group identifier.

21. The method according to claim 19, wherein determining that the forward link traffic multiplexing frame includes a group associated to the terminal includes examining a group identification field.

22. The method according to claim 19, wherein determining that the group includes a packet destined to the terminal includes examining a sub-user identifier.

23. The method according to claim 22, wherein retrieving the packet includes retrieving the packet associated to the sub-user identifier.

24. A wireless access network for transmitting a plurality of packets over a radio link, comprising:

a scheduler for scheduling a plurality of packets for transmission over a radio link;

and

a multiplexer for assembling a forward link traffic multiplexing frame by determining which packets are associated to a group, assembling the group of determined packets in the

forward link traffic multiplexing frame, providing an identification of the group in the forward link traffic multiplexing frame, and providing an identification of a destined terminal for each of the determined packets in the group.

A method and frame structure for assembling a forward link traffic multiplexing frame for transmission of packets over a radio link. The method consists of splitting a conventional user ID to provide a group ID and a sub-user ID for each packet or RLP frame. The packets belonging to each group are then assembled together in a forward link traffic multiplexing frame in which each group is identified by its group ID or a group identification field, and the packets in the group are identified according to the terminal or user to which they are destined. This splitting of the user ID results in reduced layer 2 overhead, thereby increasing system capacity for the transmission of user traffic.

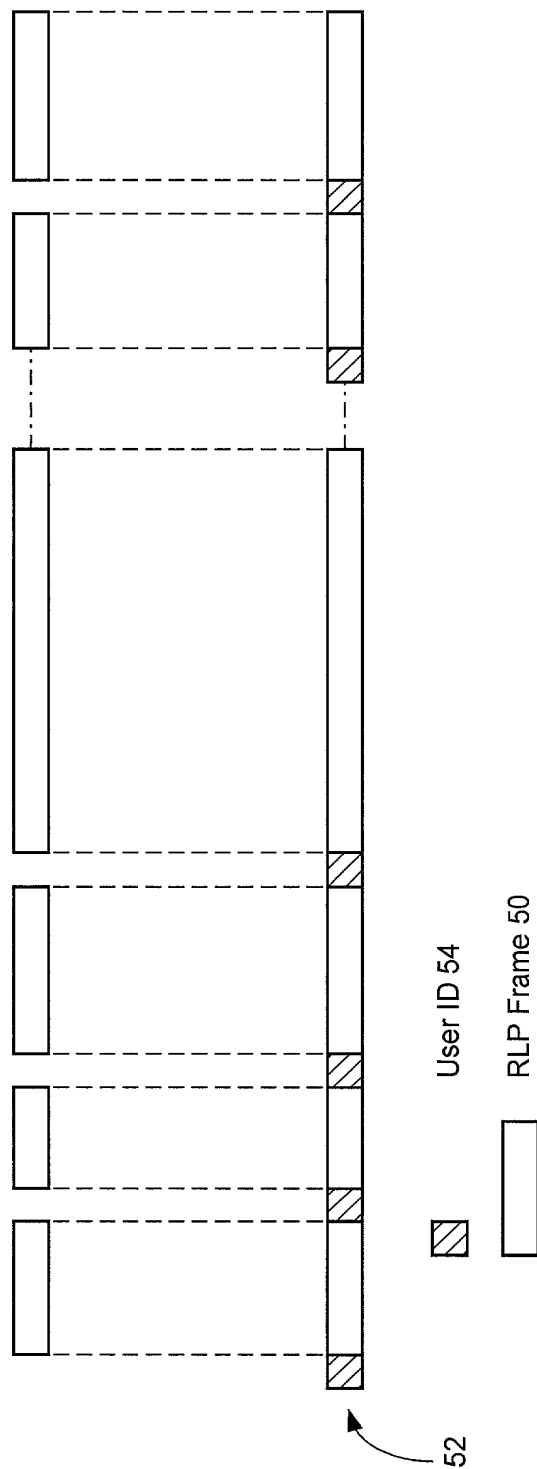


Fig. 1
(Prior Art)

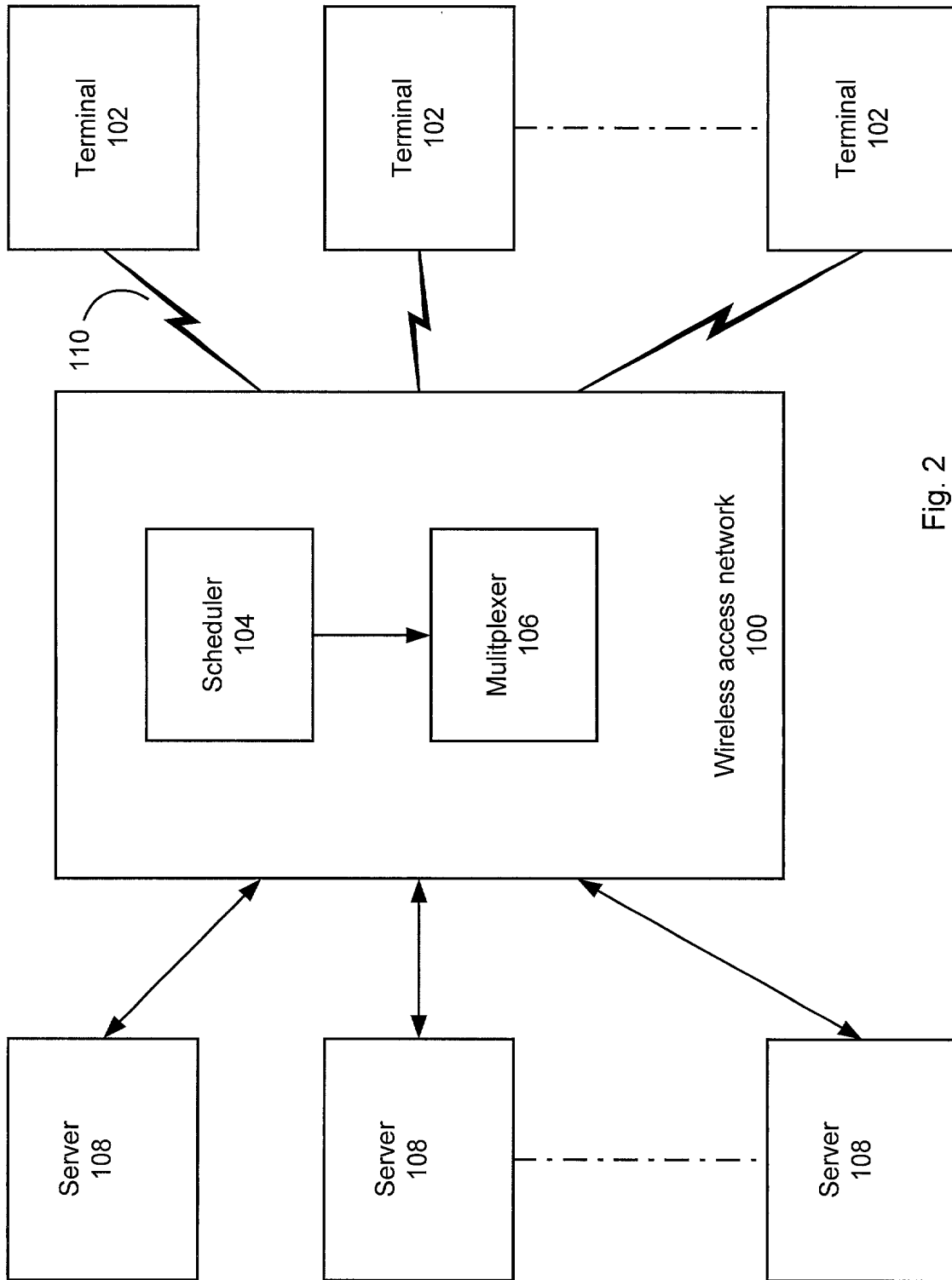


Fig. 2

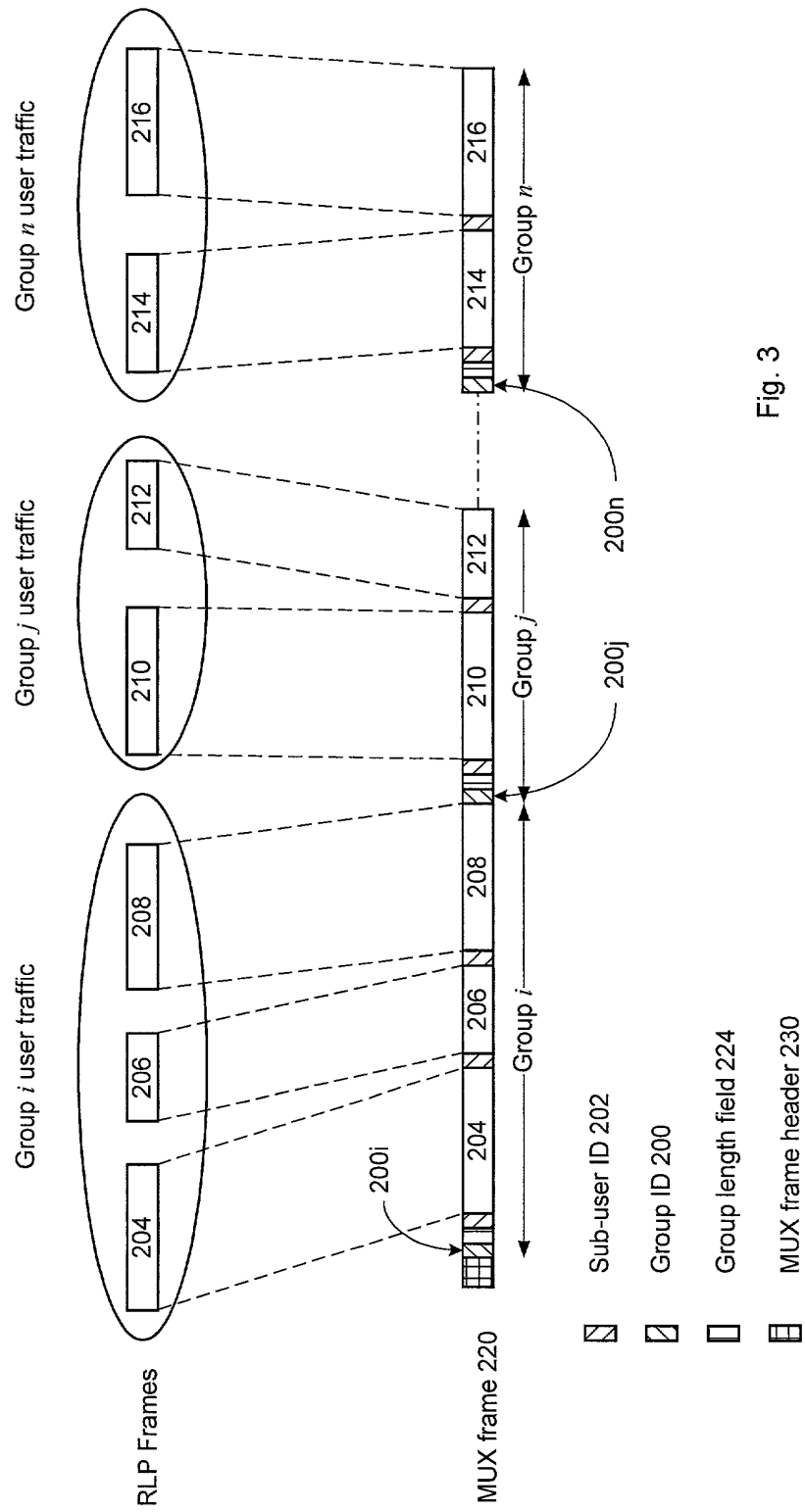


Fig. 3

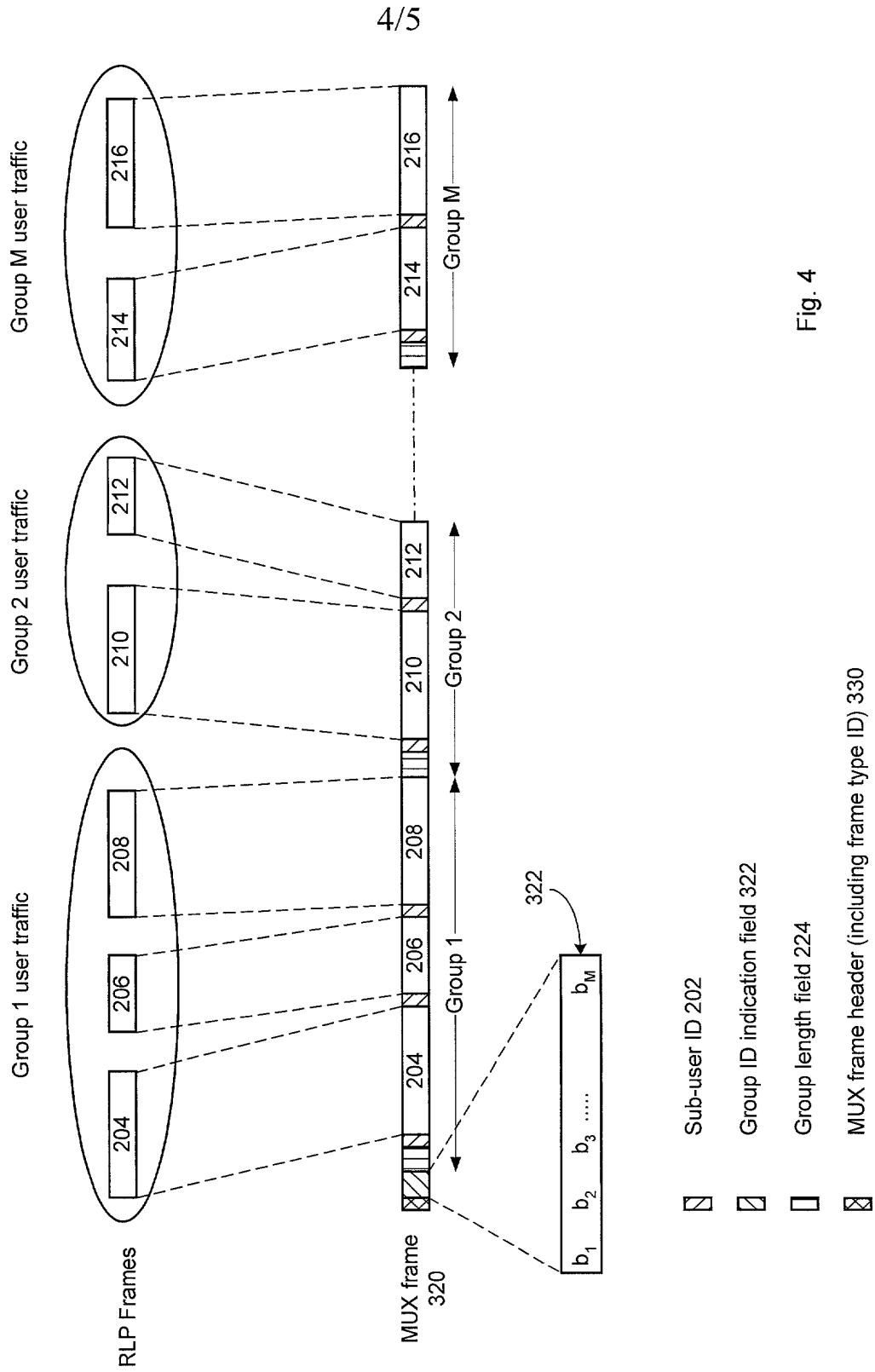


Fig. 4

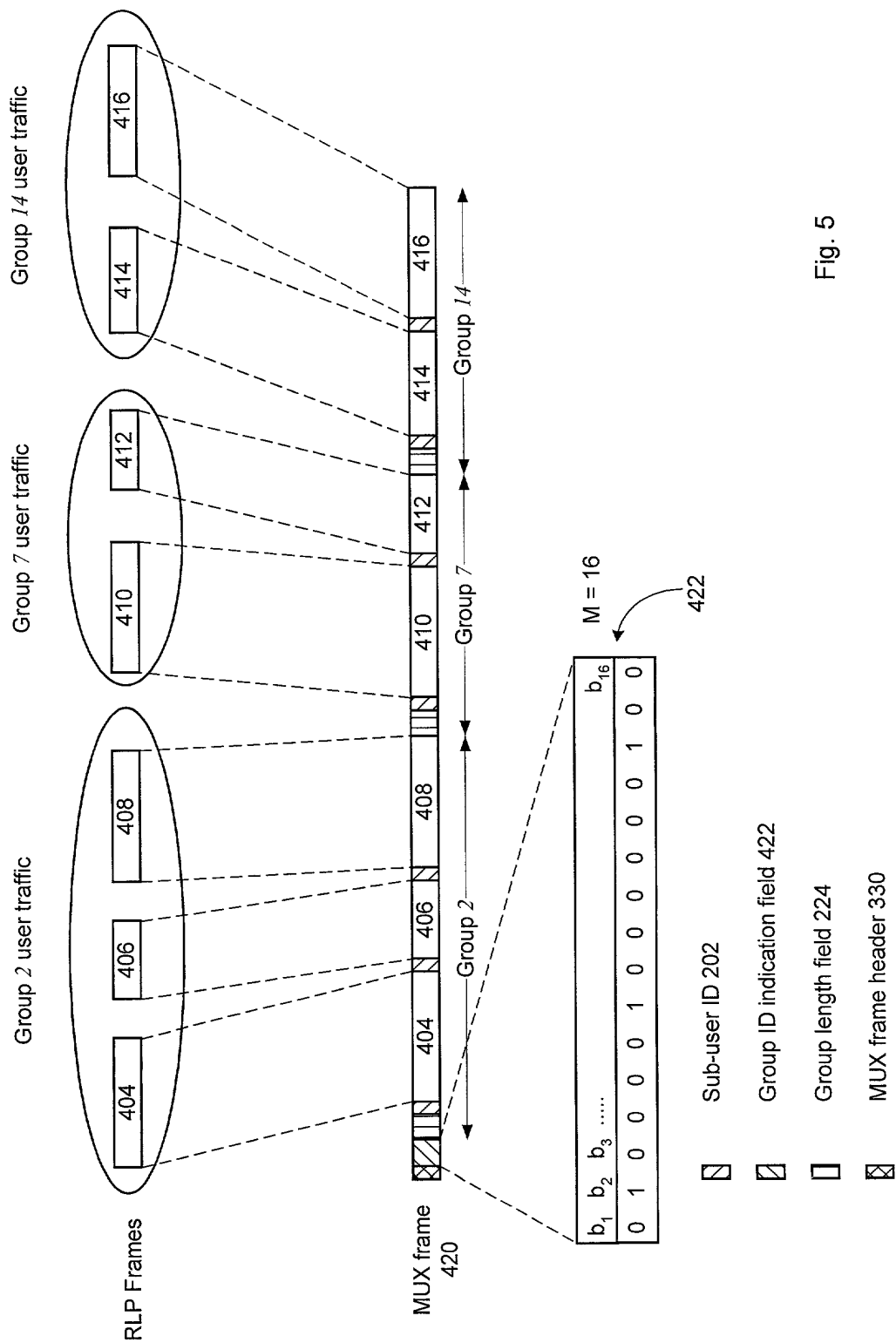


Fig. 5

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are stated below next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

METHOD FOR REDUCING OVERHEAD IN FORWARD LINK TRAFFIC MULTIPLEXING

the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S)

COUNTRY/OFFICE	APPLICATION NO.	DATE OF FILING	PRIORITY CLAIMED
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

PROVISIONAL APPLICATION NUMBER**DATE OF FILING**

09221700 442200

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or §365(c) of any PCT International application(s) designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose material information as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

**PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. §120**

Application Serial No.	Date of Filing	Status (check one)		
		Patented	Pending	Abandoned
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

POWER OF ATTORNEY

I hereby appoint the practitioners at Customer No. 26123, as my attorneys or agents with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Address all correspondence to Customer No. 26123.



26123

PATENT TRADEMARK OFFICE

Address all telephone calls to Anne Kinsman (613) 237-5160 (telefax: 613-787-3558).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1. FULL NAME OF SOLE OR FIRST INVENTOR

Hang	ZHANG	
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